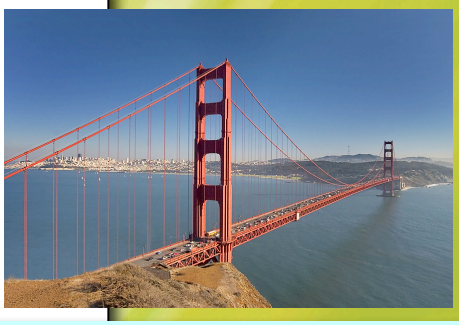
Meet the Bridges

Arch Bridge

Box-girder Bridge



Suspension Bridge

How are these bridges alike? How are they different?

A fallen tree trunk over a stream is an example of a natural bridge. The bridges that engineers design are much stronger, longer, and wider than any tree trunk. They are also very durable, although all bridges need to be inspected and maintained on a regular basis.

A bridge must be strong enough to support its **load**, which is the weight of the bridge and its own structures. The **dead load** includes the deck, which is the flat part of the bridge that cars drive across. The **live load** is the weight of the cars, trucks, and other objects that cross the bridge. The dead load stays the same, while the live load varies with the bridge traffic.

Bridges can be designed in different ways. Here are a few types of bridges.

Arch bridge This bridge is named its arch shape. Many arch bridges are made from multiple arches. The arch shape provides support by distributing the load to the **abutments**, or vertical supports.

The ancient Romans built hundreds of arch bridges across their empire. Some of them are still standing today. Many of the bridges were aqueducts, which are

The keystone is the white block at the top of the arch.

channels for carrying fresh water.

The Romans used carefully shaped stones to build the arches. The front face of the stone at the top of the arch, called the **keystone**, has a trapezoid shape. This shape lets the keystone act like a wedge to hold the arch in place. Weight applied to the top of the keystone is distributed to the left and right. The other stones distribute the weight down the two sides of the arch.

Like other modern bridges, the arch bridges of today are made of long steel beams, not individual stones. But the basic engineering principle is the same as it was in ancient times.

Box-girder bridge and other beam bridges A tree trunk that spans a stream is a simple example of a beam bridge. A beam bridge consists of one or more stiff horizontal beams that lie across posts. The greater the distance between the posts, the more likely the beams will sag due to the load. For this reason, the posts are rarely more than 75 meters (250 feet) apart.

A box-girder bridge is a type of beam bridge. The box girder is the framework above the roadway. It helps support the bridge and protects it from torsion, which is a twisting stress.

Suspension bridge This type of bridge relies on towers that rise high above the deck. The deck includes the roadway. The deck is suspended, or hung, beneath two huge cables that are supported by the towers. The weight of the deck is supported by the tension in smaller cables. This tension extends down from the two huge cables. For this reason, the ends of the huge cables must be firmly anchored to the land on either side of the bridge. If these cables snapped off their moorings, the tension would be released and the deck would fall.

Cantilever bridge

Other types of bridges A cantilever is a beam that is supported at one end only. An example of a cantilever is a balcony that projects off the

side of a building. A **cantilever bridge** is generally made from two cantilevers placed end to end, each attached to its own central tower.

Like a suspension bridge, a **cable-stayed bridge** uses towers and cables. The difference is that the cables do not hang in curved paths, but instead are attached directly to the deck. Many cables are used, and they fan out from each tower.

Cable-stayed bridge